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Notes on the Soricidae (Insectivora, Mammalia) from Crete. I. The Pleistocene species *Crocidura zimmermanni*

by

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Introduction

The recent shrew fauna of Crete is currently considered to comprise three species, two of the genus *Crocidura* and one of the genus *Suncus* (*S. etruscus*).

There has been considerable controversy about the number of Cretan *Crocidura* species and their names. Miller (1909) described *Crocidura caneae* from an unknown locality in Crete; material belonging to this taxon was subsequently referred to *C. russula caneae* (Ellermann & Morrison-Scott 1951; Wettstein 1953; Corbet 1978), *C. gueldenstaedti caneae* (Richter 1966, 1970) and *C. suaveolens* ssp. (Hutterer 1981).

Pieper (1979) described a new species as *C. ariadne* on the basis of a single specimen from an owl pellet collection. However, Hutterer (1981) provided evidence that the type specimen of *C. ariadne* is most probably a juvenile *C. suaveolens.*

Recent cytotaxonomic research (P. Vogel et al., pers. comm.) has shown unambiguously that *caneae* is a subspecies of *Crocidura suaveolens.*

A second taxon was described in 1953 by Wettstein as *C. russula zimmermanni* on the basis of a small collection from a mountainous area in Central Crete (Nida-Hochebene). Vesmanis & Kahmann (1978) consider the material as a distinct species: *C. zimmermanni.* Vogel (1986) gave cytotaxonomical evidence that *C. zimmermanni* is a species in its own right; it is known from Crete only.

In summary, I consider it a reasonably well established fact that present-day Crete is inhabited by the endemic species *Crocidura zimmermanni* Wettstein, 1953 and by *Crocidura suaveolens caneae* Miller, 1909.

Next to these, *Suncus etruscus* (Savi, 1822) has also been reported from Crete (Spitzenberger 1970; Pieper 1976).

It is a well-known fact that the Pleistocene endemic mammal fauna in Crete (an unbalanced island fauna) included *Crocidura.* De Vos (1984) gives an extensive review of the faunal composition of the Cretan Pleistocene vertebrate bearing localities; *Crocidura* sp. is mentioned from fourteen of them.

Contrary to the other faunal elements (hippopotami, elephants, deer, otter, rodents and birds) the Pleistocene shrews have so far not been the subject of a detailed study. It was thus not possible to relate the recent shrew fauna of Crete to the Pleistocene situation; the present article is meant to fill this hiatus.

Material and methods

The Pleistocene *Crocidura* material from Crete which is used in the present study was collected in the 1970's by teams from the University of Utrecht, the Netherlands, led by Dr. P.Y. Sondaar, in the framework of his project on Mediterranean island faunas.

De Vos (1984, fig. 1) published a map of Crete indicating the places of the localities; he furthermore constructed an endemic biostratigraphy for the Cretan faunal assemblages. This biostratigraphy, which is based on the murids, consists of two zones, an older *Kritimys* zone and a younger *Mus* zone. Each of the two zones is subdivided into two subzones (De Vos, 1984, fig. 37).

Crocidura is absent from the oldest subzone (the *Kritimys kiridus* subzone); but it is found in all three following ones (the *Kritimys catreus, Mus bateae* and *Mus minotaurus* subzones, respectively). For the present study I used material from six localities, representing these three subzones: Xeros (XE), Stavros-micro (SID), Stavros-cave inside (SG), Milatos 2 (MI2), Rethymnon fissure (RES), and Liko (LI). The latter one has been sampled in different lots, five of which are used (respectively, LIa, LIA, LIB, LIC and LID). Table 1 gives the biostratigraphical position of the localities used.

Table 1. Biostratigraphical position of the six studied localities.

recent		
Mus zone	*M. minotaurus* subzone	LIKO a, A, B, C, D RETHYMNON FISSURE MILATOS 2 STAVROS-CAVE INSIDE
	M. bateae subzone	STAVROS-MICRO
Kritimys zone	*K. catreus* subzone	XEROS
	K. kiridus subzone	no *Crocidura*

The material is stored in the collections of the Instituut voor Aardwetenschappen, Utrecht, the Netherlands (hereafter IVAU).

For direct comparative purposes, next to the material mentioned in Reumer & Payne (1986), I had the opportunity to study the skulls of three specimens of *Crocidura zimmermanni* that were caught in August 1985 by prof. P. Vogel. They are stored in the collections of the Institut de Zoologie et d'Ecologie Animale (IZEA), Lausanne, Switzerland: IZEA 2053, ♂, coll. 4 August 1985, Nida plain (the type locality of the species), altitude 1450 m; IZEA 2058, ♂, coll. 8 August 1985, Omalos, alt. 1050 m; IZEA 2065, ♂, coll. 11 August 1985, Omalos.

The nomenclature of dental elements and other anatomical features follows Reumer (1984).

Measurements of the material from Stavros-cave, Xeros, and Rethymnon fissure were made in 1983 at the IVAU, Utrecht, using a Leitz Ortholux microscope fitted with a movable stage and measuring clocks. The measurements of the material from Stavros-micro, Stavros-cave, Milatos 2 and the Liko samples were made in 1985 at the IZEA, Lausanne, using a Nikon Profile Projector V-12, coupled to a Nikon Digital Counter CM-6S.

As the Stavros-cave material has been measured at both moments and at both places, it is possible to make comparisons and to decide whether or not both sets of data can be used next to one another. The sets appear fully comparable, except for the measurements of P^4, which is, however, a dental element that is difficult to properly orient.

The measurements are presented in table 2. The data for Stavros-cave are based on the measurements taken in Lausanne.

Some of the parameters used are after Vesmanis (1976): zygomatic width of the skull (ZW, = Vesmanis no. 7); length of the mandible including the lower incisor (L+I, = Vesmanis 25); the same but not including I (L-I, = Vesmanis 26); length of the mandible from the condyle, not including I (LC, = Vesmanis 27); coronoid height (HC, = Vesmanis 30); height to the upper sigmoid notch (HUS, = Vesmanis 31); length of the lower condylar facet (LLF, = Vesmanis 34); condylar height (CH, = Vesmanis 35); condylar length (CL, = Vesmanis 36) and condylar width (CW, = Vesmanis 37). The remainder are after Reumer (1984): PE = length to the posterior emargination; LL = lingual length; BL = buccal length; W = width; AW = anterior width, PW = posterior width; L = length; TRW = trigonid width; TAW = talonid width.

Other abbreviations used in table 2 are: prm = parameter; n = number of observations; $\bar{x}$ = mean of the observations; sd = standard deviation.

The drawings (figs. 1 and 2) were made using a Wild M4 binocular microscope fitted with a drawing prism.

Description (figs. 1 and 2)

The material shows all the characteristics that are typical for a European *Crocidura*, and which do not need to be repeated. Its particular characters are the following.

The first upper antemolar (A^1) is the largest of the three upper AA, A^2 and A^3 being considerably smaller; A^3 ist somewhat larger than A^2. If the surface area of A^1 in sideview is taken to be 100, then the A^2 = 41.2 and the A^3 = 53.9 (mean of 6 specimens: SG 313, LIa 351 left and right, LIB 511, LIB 512 and LIB 571).

The P^4 has a small and pointed parastyle; there is no parastylar crest. The protocone of P^4 is situated in the anterolingual corner of the tooth and does not show much buccal shift. The hypocone is not developed as a cusp but only as a low crest.

The lower incisor is long and has a slightly undulate upper margin in unworn specimens. The A_1 is relatively large and elongate, it is not notably smaller than A_2 (P_4). The lower molars have only slightly curved buccal lower margins (cingula).

The anterior margin of the coronoid process has a slight bulge; the coronoid spicule is small and placed near the tip of the process. The lower margin of the internal temporal fossa is offset from the horizontal ramus in a rod-like manner. The mandibular foramen is large and open; the mental foramen is placed below the posterior half of P_4.

Taxonomy and relationships

Despite some minor differences in size (see table 2 and discussion below), the morphology is identical to that of the recent *Crocidura zimmermanni* (see figs.

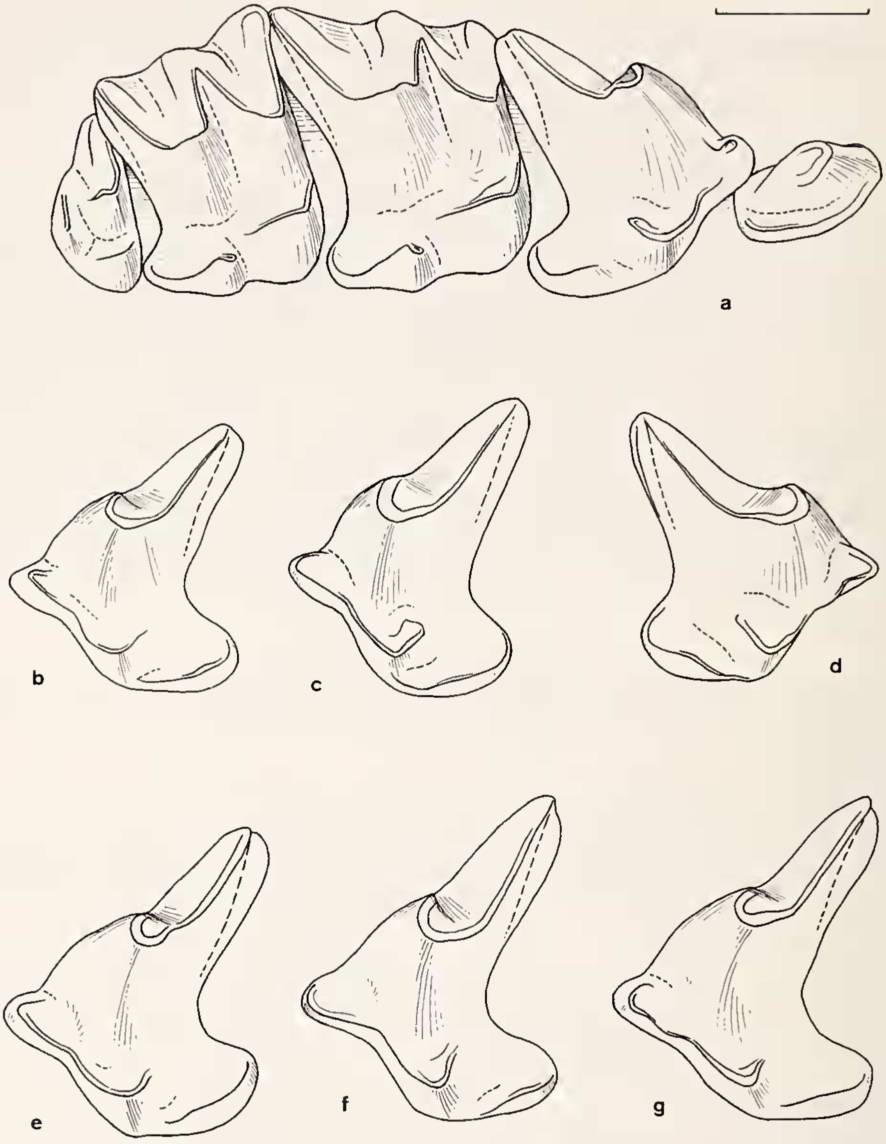

Fig. 1. a—d: *Crocidura zimmermanni*, Pleistocene, Crete (IVAU); a: right A^3—M^3, Liko (LIA 462), b: left P^4, Liko (LIB 512), c: left P^4, Stavros-cave (SG 341), d: right P^4, Stavros-cave (SG 345). e—g: *C. zimmermanni*, recent, Crete, 3 left P^4's; e: IZEA 2053, f: IZEA 2058, g: IZEA 2065. Bar indicates 1 mm.

1 and 2). As, moreover, the morphology is extremely constant in all localities examined, it seems logical to conclude that the Pleistocene Cretan shrews all belong to *Crocidura zimmermanni* Wettstein, 1953. Among the most noteworthy similarities supporting this conclusion are the position of the mental foramen below P$_4$, the morphology of the P^4 and the relative proportions of the upper

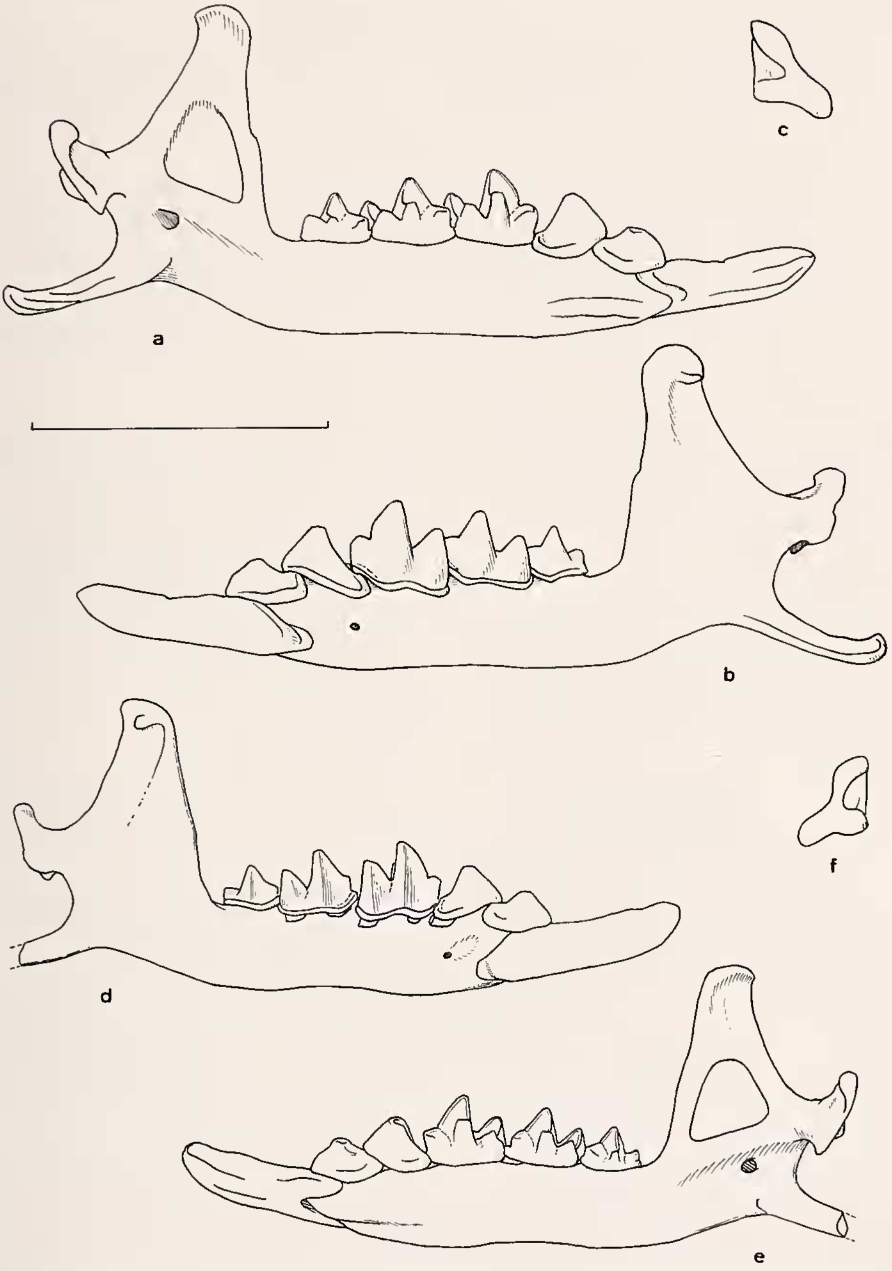

Fig. 2. a—c: *Crocidura zimmermanni,* recent, Crete (IZEA 2053), left mandible; a: lingual view, b: buccal view, c: caudal view of condyle. d—f: *C. zimmermanni,* Pleistocene, Liko, Crete (IVAU-LIa 306), right mandible; d: buccal view, e: lingual view, f: caudal view of condyle. Bar indicates 5 mm.

antemolars (which are 100 — 38.3 — 46.9 in recent *C. zimmermanni*, mean of the 6 sets of antemolars in the IZEA specimens).

Table 2: Measurements

		Xeros			Stavros micro			Stavros cave			Milatos 2			Rethymnon fissure		
element	prm	n	x	sd	n	x	sd	n	x	sd	n	x	sd	n	x	sd
skull	ZW	—			—			—			—			—		
P^4	PE	5	0.97	—	3	1.03	—	6	0.98	0.050	2	1.06	—	9	0.83	0.063
	LL	5	0.99	—	3	1.10	—	6	1.02	0.051	2	1.19	—	10	0.87	0.068
	BL	4	1.87	—	3	1.92	—	6	1.91	0.102	2	2.05	—	9	1.86	0.059
	W	5	1.51	—	3	1.54	—	6	1.55	0.078	2	1.59	—	10	1.49	0.033
M^1	PE	10	1.16	0.041	11	1.18	0.060	4	1.18	—	7	1.17	0.057	17	1.11	0.047
	LL	9	1.41	0.085	11	1.43	0.049	4	1.46	—	7	1.50	0.077	16	1.38	0.069
	BL	8	1.53	0.084	11	1.56	0.059	4	1.51	—	5	1.62	—	17	1.54	0.052
	AW	9	1.69	0.071	11	1.72	0.061	4	1.71	—	6	1.75	0.104	16	1.67	0.057
	PW	8	2.04	0.098	11	2.07	0.045	4	2.14	—	6	2.17	0.120	16	2.03	0.062
M^2	PE	4	1.08	—	7	1.06	0.071	3	1.06	—	6	1.05	0.078	16	1.02	0.032
	LL	4	1.30	—	7	1.26	0.094	3	1.31	—	5	1.25	—	15	1.22	0.052
	BL	4	1.33	—	5	1.35	—	3	1.33	—	6	1.34	0.076	14	1.28	0.044
	AW	4	1.92	—	7	1.94	0.056	3	1.92	—	5	1.89	—	11	1.87	0.056
	PW	4	1.64	—	5	1.71	—	3	1.68	—	5	1.66	—	14	1.61	0.058
M^3	L	—			5	0.67	—	—			—			—		
	W	—			5	1.34	—	—			—			—		
lower	L + I	—			1	12.90	—	—			—			—		
jaw	L—I	—			1	10.45	—	—			—			—		
	LC	—			1	10.38	—	1	10.21	—	—			—		
	HC	—			3	4.65	—	5	4.69	—	—			—		
	HUS	—			3	2.37	—	5	2.40	—	—			—		
condyle	LLF	—			4	1.37	—	6	1.30	0.033	—			—		
	CH	—			4	1.33	—	5	1.37	—	—			—		
	CL	—			4	1.95	—	5	1.91	—	—			—		
	CW	—			4	0.92	—	5	0.92	—	—			—		
M_1	TRW	24	0.99	0.043	24	0.95	0.044	13	0.96	0.044	23	0.93	0.035	43	0.93	0.037
	TAW	24	1.09	0.054	23	1.04	0.046	13	1.07	0.051	23	1.06	0.053	44	1.04	0.038
	L	24	1.65	0.053	22	1.56	0.062	13	1.58	0.076	23	1.59	0.066	44	1.54	0.036
M_2	TRW	25	0.92	0.029	14	0.89	0.044	16	0.90	0.039	19	0.91	0.025	42	0.91	0.034
	TAW	25	0.97	0.035	14	0.92	0.049	16	0.93	0.038	18	0.94	0.031	42	0.94	0.038
	L	24	1.59	0.054	14	1.53	0.036	16	1.54	0.048	18	1.58	0.054	43	1.50	0.042
M_3	W	9	0.68	0.024	12	0.65	0.023	7	0.67	0.037	8	0.66	0.032	28	0.64	0.039
	L	10	1.21	0.071	12	1.18	0.044	7	1.20	0.045	7	1.20	0.041	28	1.13	0.041
M_1—M_3	L	4	4.11	—	4	3.98	—	6	4.07	0.178	1	4.14	—	17	3.91	0.085
I-M_3	L	—			1	8.31	—	2	8.01	—	—			—		

Table 2 (continued)

Liko a			Liko A			Liko B			Liko C			Liko D			recent_sample				
n	x	sd	n	x	sd	n	x	sd	n	x	sd	n	x	sd	n	x	sd	prm	element
2	6.10	—	1	6.12	—	2	5.97	—	—			1	5.81	—	3	6.25	—	ZW	skull
5	1.06	—	17	1.01	0.063	11	0.99	0.069	—			7	1.01	0.043	6	1.06	0.080	PE	P^4
5	1.13	—	18	1.09	0.060	12	1.06	0.064	—			7	1.09	0.028	6	1.16	0.080	LL	
6	1.97	0.037	18	1.90	0.048	14	1.90	0.047	—			7	1.90	0.040	6	2.06	0.046	BL	
6	1.53	0.040	18	1.54	0.072	14	1.54	0.075	—			7	1.50	0.032	6	1.55	0.057	W	
6	1.15	0.035	20	1.12	0.038	15	1.12	0.048	—			6	1.11	0.007	6	1.10	0.037	PE	M^1
6	1.42	0.033	22	1.41	0.050	15	1.42	0.073	—			6	1.41	0.038	6	1.41	0.041	LL	
6	1.56	0.058	22	1.54	0.059	14	1.52	0.058	—			6	1.49	0.057	6	1.56	0.046	BL	
6	1.69	0.030	22	1.68	0.046	14	1.69	0.049	—			6	1.63	0.062	6	1.74	0.077	AW	
6	2.07	0.055	21	2.08	0.057	14	2.08	0.050	—			5	2.03	—	6	2.17	0.059	PW	
6	1.04	0.033	17	1.05	0.036	11	1.05	0.037	—			6	1.02	0.018	6	1.05	0.030	PE	M^2
6	1.24	0.042	17	1.26	0.057	10	1.28	0.047	—			6	1.23	0.048	6	1.28	0.021	LL	
6	1.31	0.056	16	1.31	0.049	9	1.29	0.054	—			6	1.28	0.039	6	1.33	0.018	BL	
5	1.93	—	16	1.92	0.045	10	1.91	0.064	—			5	1.88	—	6	1.97	0.055	AW	
6	1.63	0.055	16	1.63	0.048	9	1.64	0.063	—			6	1.58	0.064	6	1.68	0.030	PW	
5	0.60	—	1	0.62	—	1	0.61	—	—			2	0.60	—	6	0.60	0.029	L	M^3
4	1.24	—	1	1.30	—	1	1.32	—	—			2	1.16	—	6	1.19	0.034	W	
—			—			—			—			—			6	13.91	0.281	L+1	lower
1	10.83	—	1	10.70	—	1	10.62	—	—			—			6	11.47	0.194	L—1	jaw
10	10.39	0.175	4	10.27	—	6	10.11	0.293	7	10.49	0.304	1	9.76	—	6	10.99	0.154	LC	
23	4.62	0.150	32	4.53	0.113	27	4.55	0.117	9	4.69	0.138	9	4.53	0.122	6	4.99	0.168	HC	
22	2.32	0.098	28	2.29	0.092	21	2.29	0.083	11	2.39	0.069	7	2.30	0.061	6	2.46	0.108	HUS	
21	1.25	0.071	28	1.21	0.088	28	1.20	0.070	11	1.30	0.067	7	1.20	0.105	6	1.41	0.030	LLF	condyle
23	1.29	0.098	27	1.28	0.070	26	1.29	0.082	10	1.32	0.083	7	1.26	0.067	6	1.47	0.117	CH	
20	1.89	0.080	27	1.85	0.111	26	1.84	0.094	10	1.95	0.064	7	1.80	0.117	6	2.10	0.089	CL	
25	0.85	0.076	26	0.83	0.073	25	0.83	0.078	12	0.88	0.073	7	0.83	0.054	6	0.96	0.070	CW	
34	0.95	0.041	35	0.93	0.038	39	0.93	0.038	17	0.96	0.035	40	0.94	0.033	6	0.97	0.023	TRW	M_1
34	1.05	0.045	35	1.04	0.035	39	1.04	0.045	17	1.07	0.036	40	1.05	0.033	6	1.11	0.023	TAW	
34	1.56	0.060	35	1.53	0.064	38	1.53	0.054	17	1.57	0.045	38	1.54	0.054	6	1.61	0.030	L	
31	0.91	0.037	36	0.89	0.029	33	0.89	0.038	11	0.92	0.035	40	0.91	0.025	6	0.95	0.012	TRW	M_2
31	0.94	0.040	36	0.92	0.026	33	0.92	0.041	11	0.95	0.039	40	0.94	0.030	6	1.00	0.013	TAW	
31	1.53	0.053	35	1.48	0.040	33	1.49	0.051	11	1.49	0.054	40	1.50	0.040	6	1.54	0.032	L	
21	0.68	0.032	24	0.65	0.026	24	0.65	0.029	8	0.67	0.033	25	0.66	0.028	6	0.67	0.017	W	M_3
21	1.16	0.046	23	1.13	0.043	24	1.13	0.056	8	1.13	0.063	25	1.15	0.049	6	1.16	0.018	L	
20	3.98	0.138	19	3.91	0.091	20	3.92	0.106	8	3.89	0.075	20	3.93	0.119	6	3.99	0.051	L	M_1—M_3
9	8.28	0.225	2	8.18	—	4	8.14	—	4	8.06	—	1	8.56	—	6	8.63	0.167	L	1—M_3

The conclusion that the Pleistocene shrews of Crete belong to the still existing species *C. zimmermanni* implies that this taxon is an old one. The oldest studied locality is Xeros, where *C. zimmermanni* is found associated with *Kritimys catreus*. This is also the case in the unstudied localities Bali 2 and Kharoumes A; together, these three localities are placed at the base of the *Kritimys catreus* subzone (De Vos 1984).

C. zimmermanni was present throughout the *K. catreus* subzone, the entire *Mus* zone, up till the present day.

It is virtually impossible to assign dates to the Cretan biostratigraphical units, both in absolute terms and in terms of correlation with the marine or continental stratigraphy of the mainland. However, to consider the *Kritimys* zone as belonging to the lower half of the Pleistocene is probably neither imprudent nor unjustified. This would imply that *C. zimmermanni* reached Crete sometime during the early Pleistocene.

Representatives of the genus *Crocidura* are known from that time (and somewhat before it) from the continental regions surrounding the Aegean Sea. Van de Weerd et al. (1982) reported *Crocidura* sp. from the Late Ruscinian deposits at Apolakkia, Rhodes. Reumer & Doukas (1985) described a *C.* sp. from the Early Villányian of Tourkobounia 1 (Athens) and *C. kornfeldi* Kormos, 1934 from the Early Biharian of Tourkobounia 2, 3 and 5.

The Cretan *C. zimmermanni* may have originated from an invasion of either *C.* sp. or (the larger and younger) *C. kornfeldi* into Crete. Morphological comparison to *C.* sp. from Apolakkia or Tourkobounia 1 is hampered by the scantiness of *C.* sp. remains. Comparison between *C. zimmermanni* and *C. kornfeldi* is quite possible (Reumer 1984). Among the similarities are the general shape of P^4, the relative proportion of the upper antemolars; the morphology of the medial region of the ascending ramus; and the elongate A_1.

A difference is found in the position of the mental foramen, which is more posteriorly placed in *C. kornfeldi*. Furthermore, *C. zimmermanni* appears to be somewhat larger than *C. kornfeldi*, which is, however, what can be expected for an island species (see also discussion below).

I suppose that *C. zimmermanni* is a direct descendant of *C. kornfeldi*. The characters that separate the other Early and Middle Pleistocene species (viz. *C. obtusa* Kretzoi, 1938 and *C. zorzii* Pasa, 1947) from *C. kornfeldi* are also valid with regard to *C. zimmermanni*, and exclude the former two species to have an ancestral relationship to *C. zimmermanni*.

What is the relationship between *C. zimmermanni* and the three other living European *Crocidura* species (*C. russula*, *C. suaveolens* and *C. leucodon*)? Catzeflis (1984) made a biogeographical reconstruction of the origin of these three species. His conclusions are that *C. suaveolens* invaded Europe from the Near East during the Riss-Würm interglacial. The subsequent Würm glacial forced the taxon into refuge areas in Southern and Southeastern Europe, enabling morphological and biochemical polymorphism to develop. *C. russula* and *C.*

leucodon were absent from Würmian Europe and (re?) invaded after the Würm; *C. russula* from Northwestern Africa, *C. leucodon* from the Near East (see Catzeflis 1984, p. 125 and fig. 70).

Apparently, these three *Crocidura* species invaded Europe to replace earlier representatives of the genus (such as *C. kornfeldi, C. zorzii* and *C. obtusa*). There is no immediate phyletic relationship between the Early and Middle Pleistocene species (*C. kornfeldi, C. zorzii, C. obtusa*) and, hence, *C. zimmermanni* on the one hand, and the Late Pleistocene to recent East Mediterranean species (*C. suaveolens, C. leucodon*) on the other hand. Vogel et al. (in prep.) show that *C. russula* is phylogenetically still further away.

Discussion

It can be inferred from the data given in table 2 that *C. zimmermanni* did not undergo noteworthy size-changes during the Pleistocene. There are some minor size changes, but they do not show any consistent long-term trend. This contrasts the situation found with another Pleistocene island shrew (*Nesiotites ponsi* — *N. hidalgo* from Majorca), in which a gradual size-increase has been observed (Reumer 1980). This difference can be explained by the presence in Crete of terrestrial predators (otters, running owls), that were absent from Majorca, and that caused a different selective pressure on the body size of small mammals.

There are some important differences to be observed between the measurements of the Pleistocene *C. zimmermanni* and the rich *C. kornfeldi* material from Villány 3 in Hungary (Reumer 1984, table 1). These would suggest, if the hypothesis that *C. zimmermanni* is a direct descendant of *C. kornfeldi* is correct, that a slight size-increase took place after the introduction onto Crete. However, the scanty data for *C. kornfeldi* material from Osztramos 3/2 (also in Hungary; Reumer 1984, table 2) do not suggest any size-change, while the data from Tourkobounia (Reumer & Doukas, unpublished) are undecisive in this respect. A firm conclusion can not be arrived at, therefore.

A slight general increase in size can be observed between the Pleistocene and the recent specimens of *C. zimmermanni* (see table 2, most noteworthy in parameters like ZW, L-I, LC, HC and LI-M3). As size-change is a relatively easy and effective way to deal with environmental changes (Hausser, pers. comm.), it is likely that this slight size-increase came about after the introduction by man of *C. suaveolens caneae* and *Suncus etruscus* (Reumer & Payne 1986). These introductions doubtlessly forced *C. zimmermanni* into other or more restricted ecological niches. While during the Pleistocene the species lived abundantly in coastal regions, it seems now to be restricted to areas of higher altitude.

Some more considerations are worth mentioning. *Crocidura kornfeldi* is a species which occurs in the Late Villányian and Early Biharian of mainland Europe (Reumer 1984; Reumer & Doukas 1985). The oldest occurence of *C. zimmermanni* in Crete is in the lower part of the *Kritimys catreus* subzone. If, again, the hypothesis of the relationship between both species is correct, this would imply that this lower part of the *K. catreus* subzone cannot be older than the Late Villányian.

The present-day population of *C. zimmermanni* is a relic in two senses. Firstly, it is a direct descendant of the Early and Middle Pleistocene group of *Crocidura* species that have since disappeared from Europe and that have been replaced by the presently living species.

Secondly, it is the only known survivor ot the wealth of endemic species that were found in most of the larger Mediterranean islands during the Pleistocene. For both reasons, *C. zimmermanni* deserves active conservation.

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Summary

The Pleistocene shrews from six Cretan localities, representing both the *Kritimys* and the *Mus* zones, are studied. It is concluded that all material belongs to the extant species *Crocidura zimmermanni* Wettstein, 1953. The hypothesis is put forward that *C. kornfeldi* Kormos, 1934 is the direct ancestor of *C. zimmermanni.* The latter species has therefore no close phyletic relationship to any of the three recent European *Crocidura* species (*C. suaveolens, C. leucodon* and the more distant *C. russula*). *C. zimmermanni* is a relic of the Early and Middle Pleistocene group of European *Crocidura* species, and of the Pleistocene Mediterranean island faunas.

Zusammenfassung

Pleistozäne Spitzmäuse aus der *Kritimys* und *Mus* Zone von sechs Lokalitäten Kretas wurden untersucht. Es wird geschlossen, daß alle Reste der rezenten *Crocidura zimmermanni* Wettstein, 1953 angehören. Die Hypothese wird aufgestellt, daß *C. kornfeldi* Kormos, 1934 der direkte Vorläufer von *C. zimmermanni* ist. Letztere Art hat daher keine engen phyletischen Beziehungen zu einer der drei rezenten europäischen *Crocidura*-Arten. *C. zimmermanni* ist ein Relikt aus der Artengruppe, die im Früh- und Mittelpleistozän Europa besiedelte, und aus den pleistozänen Inselfaunen des Mittelmeers.

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